The NASA "Why?" Files
The Case of the
"Wright" Invention

Segment 3

The tree house detectives are ready to test various reflective materials that will help make bicycles more visible and safer at night. They enlist help from a NASA “Why?” Files Kids’ Club classroom in Riverside, Ohio, that shares their test results and the safety ratings they determined for fluorescent paint, a glow stick, neon pink poster board, and reflective stickers. After a visit to Dr. D’s lab, the tree house detectives are ready to learn about designing their invention and building a model. They go to NASA Langley Research Center in Hampton, Virginia, to visit Marty Waszak to learn about iterative design and talk to Sam James to discover how models are built at NASA. The tree house detectives determine that their next step is to learn more about testing. While visiting the Wright Brothers National Memorial in Kitty Hawk, North Carolina, Jacob once again bumps into Orville and Wilbur Wright. As the brothers wait to test their glider on Jockey’s Ridge, they help Jacob understand the importance of testing in the “Wright” conditions.

Objectives

The students will

- plan and conduct a simple investigation.
- employ simple equipment and tools to gather data and extend the senses.
- use data to construct a reasonable explanation and communicate the results.
- understand that light interacts with matter by transmission, absorption, or scattering (reflection).
- design a product.
- build a model of a product.
- understand that perfectly designed solutions to problems do not exist.

Vocabulary

design - features of shape, configuration, pattern or ornamentation that can be judged by the eye in finished products.

fluorescence - the giving off or the property of a substance that gives off radiation, usually as visible light when exposed to radiation from another source

glider - an aircraft without an engine that glides on air currents

iterate - to do something over again or repeatedly

prototype - an original model on which something is formed

microaerial vehicle (MAV) - a small aircraft not larger than 6 inches and capable of flying at speeds up to 25 mph. Inspired by insects and birds, these aircraft can be used for missions of surveillance and measurements in situations where larger vehicles are not practical.

model - a small but exact copy of something; a pattern or figure of something to be made

mold - the frame on, around, or in which something is constructed or shaped

replica - a copy that is exact in all details

scale model - the reduced size of a picture, plan, or model of an object, as compared to its actual size

Video Component

Implementation Strategy

The NASA "Why?" Files is designed to enhance and enrich the existing curriculum. Full use of the video, resources, activities, and web site usually requires two to three days of class time per segment.

Before Viewing

1. Prior to viewing Segment 3 of *The Case of the "Wright" Invention*, discuss the previous two segments to review the problem and discuss what the tree house detectives have learned about the invention process thus far. Use the problem board to help sort the information.
2. Review the list of issues and questions that the students revised and/or created prior to viewing Segment 2. Determine which, if any, were answered in the video or in the students' own research.
3. Focus Questions—Print the questions from the web site ahead of time to allow students time to copy them into their science journals. Remind students to look for the Focus Question icon as the answers to the focus question appear.

View Segment 3 of the Video

For optimal educational benefit, view *The Case of the "Wright" Invention* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. At the end of Segment 3, lead students in a discussion of the focus questions for segment 3 and record answers.
2. Have students discuss and reflect in their science journals the "What's Up?" questions asked at the end of each segment.
3. Choose activities from the educator's guide and

web site to reinforce concepts presented in the segment. The variety of activities is designed to enrich and enhance your curriculum.

4. Review and/or perform the classroom experiment on reflective materials and discuss the safety ratings determined by the students. Have students work in groups or as a class to brainstorm for ideas about how the various materials could be used to help make bikes safer at night. Discuss each idea and reach a class consensus on the best solution. Extend the discussion to predict how the tree house detectives will use this information and what their final design will look like.

Careers

control engineer
aerodynamicist
wind tunnel engineer
technician
biologist
computer programmer
model builder

5. Continue working on the Problem-Based Learning activity on the web site. Have students use the Research Rack and the experiments located in Dr. D's Lab. Visit the Media Zone to learn more about the experts that were interviewed in this segment. Check out some of the great web sites that are referenced.
6. Have students reflect in their journals what they have learned from this segment and from their own experimentation and research. If needed, give students specific questions to reflect upon.
7. The NASA "Why?" Files web site provides checklists and rubrics that may assist teachers in assessing students' understanding of the material presented. These items may be found in the "Tools" section of the educators' area.

Resources

Books

Bender, Lionel: *Eyewitness Books: Invention*. Dorling Kindersley Publishing, Inc., 2000, ISBN: 0789457687

Krensky, Stephen: *Taking Flight: The Story of the Wright Brothers (Ready-To-Read)*. Simon & Schuster (Juv), 2000, ISBN: 0689812256

CDs

InventorLabs—Transportation
Enter the world of four great inventors who gave wings—and wheels—to all mankind. Meet the Wright brothers, Gottlieb Daimler, and George Stephenson and join them in their labs to explore their inventions: the flying machine, the Mercedes automobile, and the first practical locomotive, respectively. An interactive CD lets you use your ingenuity to build your vehicle. Published by Simon & Schuster Interactive, 2000, ISBN 0743522028

Web Sites

Aviation for Little Folks
Teach your students the parts of an airplane and how to fold a super-duper paper airplane with this NASA Educational Online Activity from NASA Spacelink. Designed for grades K-4.
http://spacelink.nasa.gov/Instructional.Materials/On-line.Educational.Activities/Aviation/index.html

Wright Flyer Online
At this web site you will learn about the Wright Flyer Project, in which a full-sized replica of the 1903 Wright Flyer was tested in a wind tunnel at NASA Ames Research Center. Meet the people involved in the project, travel back in time to the early days of aviation, and use the activities to connect it all to the classroom.
http://quest.nasa.gov/aero/wright/

3M Collaborative Invention Unit
At this site, learn what it takes to be an inventor and explore being a scout, wizard, critic, and trailblazer. Take a look at other great inventors to find out if you have the "Wright" stuff to become an inventor.
http://mustang.coled.umn.edu/inventing/Inventing.html

The Tech Museum of Innovation
The Tech Museum of Innovation in San Jose, California, is a hands-on technology museum devoted to inspiring the innovator in everyone. Visit the teacher section for ideas and lesson plans or the discover section for online and interactive exhibits.
http://www.thetech.org/

To Fly Is Everything
This web site is one of the largest collections of Wright brother's information and activities. It includes a complete, original narrative about the invention of the airplane, all 301 Wright photos from the Library of Congress collection, a computer simulation of the Wright wind tunnel, brief biographies of all early aviators, and brief descriptions of airplanes.
http://hawaii.psychology.msstate.edu/invent

The CERES S'COOL Project
The CERES S'COOL (Students' Cloud Observations Online) Project invites schools around the world to make ground truth measurements for a NASA Earth-observing satellite mission.
http://asd-www.larc.nasa.gov/SCOOL/

Activities and Worksheets

* Activities for invention contest booklet

To Reflect or Not To Reflect

Problem

To determine the most visible material for bike safety at night

Background

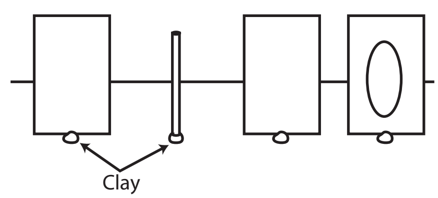
Reflective light is light that hits an object and then shines back. If an object is capable of shining by itself, it is said to "glow." Conduct research to learn more about reflective light and glowing light.

Materials (per group)

neon pink construction paper or poster board 5 cm X 10 cm
glow stick
white poster board 5 cm X 10 cm
fluorescent paint (any color)
reflective sticker approximately 5 cm X 10 cm
flashlight
paint brush
clay
tabletop
large box (approximately 60 cm X 60 cm) with one end cut out

Procedure

1. Using the paintbrush, completely cover the white poster board with fluorescent paint and let it dry.
2. Divide the clay into four equal parts and roll into small balls.
3. On a table place the clay balls in a straight line approximately 5 to 8 cm apart.
4. Open the glow stick and follow the package directions to start the chemical reaction that creates the glow.
5. Insert the four test items into the clay balls so that they stand upright.
6. Cover the test items with the cardboard box. To create a darker environment for a more accurate test, dim or turn off the lights in the room.
7. Turn the flashlight on and shine a beam of light on the first test item.
8. Observe and record your observations in the data chart.
9. Repeat steps 7-8 for each of the other test items.
10. After conducting the tests, determine the safety rating (1-5) for each test item. Use a rating of 1 if the item would have very poor visibility at night and a rating of 5 if it would be very visible at night.



Conclusion

1. Which item reflected light the best? ______________________________
2. Which item created its own light? ______________________________
3. Of these two items, which one would be the most visible material for bike safety at night? Why? ______________________________
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4. Is the most visible material the best choice for bike safety at night? Why or why not? ______
____
5. What are some other factors that would need to be considered before using this item for bike safety at night? ______________________________
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Dazzling Doggie Designs

One part of the invention process is to carefully design your invention. It is important to design your invention with as much detail as possible. A well-designed invention will be easier for others to understand and easier to build.

Using the objects below, design an automatic dog feeder. Once you have determined your design, cut out the pictures and glue them onto a piece of construction paper to reflect your design. Use a pencil or marker to add additional details as needed.

The Iterative Process

The tree house detectives learned from Mr. Waszak that designing is an iterative process. Iterative means that first you design something, build it, test it, and then you analyze the data from the tests. From the data, the design is modified over and over again until it is correct. To begin the iterative process for your invention, carefully design and draw your invention. Remember to draw your invention in detail and label it clearly, neatly, and correctly so that others will understand how the invention works. In your Inventor's Log, draw a final copy and write a detailed description of your invention.

Draw your invention here:

Description of your invention: ______________________________

Spaghetti Anyone?

Problems

To practice building models
To build the tallest freestanding spaghetti structure

Procedure

1. Discuss in your group possible designs for the spaghetti structure.
2. Draw a design of your structure in your science journal.
3. Discuss any changes that need to be made to the design.
4. Draw the final design at the bottom of this page.
5. Using the masking tape to connect the spaghetti, create a model from your design drawings.
6. Measure and record the height of your structure.
7. Share your model with the class and compare heights to other models.
8. The tallest freestanding structure wins!

Materials

uncooked thick spaghetti
100 cm (1 m) of masking tape
scissors (to cut spaghetti)
science journal
pencil
metric ruler or meter stick

Name of Model: ______________________________ Height: ____________ cm

Designers: ____

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Model Making

It is time to make a model of your invention! Use the suggested list of ideas to help you make your model.

Before making a model, research model making. Visit the library for books on model making or conduct an internet search.

Think about the materials that you will need to make the model. What supplies will you need? How much will they cost? Be imaginative and creative in making your model. List the supplies needed below:

1. ______________________ 8. ______________________

2. ______________________ 9. ______________________

3. ______________________ 10. ______________________

4. ______________________ 11. ______________________

5. ______________________ 12. ______________________

6. ______________________ 13. ______________________

7. ______________________ 14. ______________________

Look at your design carefully and in your Inventor's Log, write in detail the steps that you will follow to build your model. Writing out the steps will help you work out problems before you start the actual building process. This step will help save you time and money as it may prevent you from having to throw out the model and start over!

Solicit help from an adult if you must use any dangerous items. You may get help from anyone in making your model as long as your idea, design, drawings, and written description are your own.

Try to make your finished model as attractive as possible.

Good luck!